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TECHNOLOGY, OUR MOST VERSATILE RESOURCE

Talk by Dr. Byron T. Shaw, Administrator, Agricultural Research Service, U. S. Department of Agriculture, at dedication of new Southwestern Great Plains Field Station laboratory, Bushland, Texas, October 3, 1962

I am glad to be here today to dedicate this laboratory. It is satisfying to see the results of our hopes and efforts as they have materialized in this first unit of an expanded Southwestern Great Plains Field Station.

Completion of this Station, with adequate equipment and long-needed space in up-to-date buildings, has top priority with us in meeting future research needs of soil and water conservation.

You, and the people in other States of the Southern High Plains, have been vitally concerned with those needs. You have supported the work here wholeheartedly. If you had not, we would not be dedicating this building today.

Ever since the station was established in 1938, its scientists have worked closely with the Soil Conservation Service, the Extension Service, the Soil Conservation Districts, and other cooperators. Research results have been put to work on your farms and ranches. We're grateful for this cooperation. We have also enjoyed fine relations over the years with the Agricultural Experiment Station of the Texas A. and M. College System, whose scientists share our space here.

We need the skills of chemists, hydrologists, physicists, biologists, engineers, economists, and many other disciplines to solve the many-sided problems of land and water use. Such a team approach requires modern facilities. It is frustrating and wasteful to hamper highly trained scientists with poorly equipped, outdated buildings.

Our need for imaginative scientists and the keenest of research tools has never been greater. We are living in an age when wise use and conservation of our natural resources is more crucial than ever before. We have used many of these resources wastefully, and ever-mounting demands loom ahead.

Although the supply of these resources is fixed, the way we use them is not. Man's own curiosity and inventiveness have fashioned an instrument that can expand and extend the earth's natural riches amazingly. This is technology -- applied science. Technology is in itself a resource. It is the only one that we can use lavishly.

By showing us how to conserve our other resources, technology can greatly extend their life span -- we don't know how far. For nobody, not even the scientist who develops a new technique, can predict its future impact. The changes that science itself produces make technology our most versatile and unpredictable resource.

Twenty years ago, for example, only certain higher grade ores could profitably be mined and refined. Today, technology has lengthened by many years the life of our mineral reserves by making it possible to recover metal from lower grade ores.

As scientists estimate the centuries that the world's shrinking oil and coal reserves will last, technology is developing another resource, nuclear power, that could extend or replace all the fossil fuels of the world.

Technology is also improving and increasing our limited and declining soil and water resources as we go along. Forty years ago, for example, an acre of soil was not nearly as large as it is now. Last year, each acre of land used for crops was producing about 65 percent more than a 1920 acre did. We were producing a half more in crops last year on 28 million fewer acres than we used in 1920. And in livestock, the average breeding animal was producing 95 percent more than it did in 1920.

Technology has made the difference.

To some, the strides that have been made in increasing agricultural productivity obscure the need for more research today. Why is it important that we do conservation research now, when we have more of some crops than we can use? Why should we try to increase yields when we already have bumper crops?

If we have any regard for the future and the people who come after us, we must do more than hold our own. We must try to repair past damages to our land and water resources and improve the land for the greater demands of the future.

We must do this to preserve our own welfare. But this is not enough. The world is becoming more crowded and the mutual dependence of all nations on the world's resources is increasing.

These resources, many of them already seriously depleted, must soon support tremendous increases in population.

It is difficult to visualize the astounding rate at which the world's population is growing. With 200 babies born on this earth every minute, the worldwide increase could populate another United States in 4 years. It is estimated that more than 3 billion people now occupy the globe. This figure will double by the year 2000 if population continues to grow at its present rate.

Populations will increase fastest in the underdeveloped areas of the world that are least able to support even the people there now. Many newly emerging nations are going to need vastly more energy, minerals, and other natural resources in order to raise their standards of living.

The most important help we can give to emerging nations may well be to share our technology in production of food and in protection of natural resources.

We have learned a lot about how to use our soil and water resources wisely and economically, but we still have along way to go.

Agriculture is this country's greatest user of land and water, and it is not using either as efficiently as it can and must.

Our early history was one of exploitation. We started out by settling the Eastern Seaboard and taking all we could get from the soil. When that was depleted, we moved on. We cannot do that forever. We have reached the geographic boundaries of our soil resources. And as we view what we have done to our soils in a few centuries, we must be concerned.

Despite current conservation efforts, most of the soils of the United States are still deteriorating. The exceptions are in the Northeast and in much of the Southeast, where low-producing soils have been improved until they are better now than they ever were. Practically all southern soils need further improvement. In the north central area, the Corn Belt, soils are still going downhill, but we know how to halt deterioration and improve them.

But all over the Great Plains, soils are going downhill and we don't know how to reverse the trend. They are deteriorating in structure and declining in fertility and organic content. Improved efficiency in farm operations frequently makes these deteriorating soils sustain high yields. However, this fact only helps to mask the problem.

We must learn how to stop this drain because our cropland acreage is going to shrink.

As population grows, urbanization and industry, wildlife and recreation are going to require more and more land. For example, it's predicted that by 1980 we will need 23 million more acres in recreation and wildlife areas. There will be 50 to 60 million hunters and fishermen by then, twice the number we now have. A lot of these expanded needs must be met from land now used for agriculture.

Much cropland will also shift to grass because livestock is going to need more pasture and range -- 22 million acres more by 1980.

As land shifts from crop production to other uses, we must produce more on less acreage.

When we look into the future, we see need in 1980 for over 40 percent more food, feed, and fiber than we produced in 1961. Yet, instead of having <u>more</u> land in production, we may be using 33 million <u>less</u> acres for crops, pasture, and range.

It will take sciencee and technology, of course, to make this possible. We must maintain a flow of research results. Long-range investigations that may solve some of the complex problems of 1980 are already under way.

As resources become more scarce, technology can often devise new methods to develop them. However, the cost is likely to go up. This has already happened with many of our minerals. It is happening with water here in the Texas High Plains, where dropping water tables have forced people to lower pumps, run them longer, put in more wells, or cut down on the acreage they irrigate.

We must learn not only how to stretch the life of our depleted resources, but also how to do it at a cost that people can afford. Let's not price good soil and sufficient water out of our children's reach.

Our need for more water is growing rapidly. We're now using about 250 billion gallons a day in this country, and by 1980 we'll need almost $2\frac{1}{2}$ times that much.

The future development of the West may well be limited by lack of water. Municipal and industrial needs, and requirements that we cannot even conceive of today, make it imperative that every possible technique be developed to cope with the mounting water problems of the West.

Much of our water research concentrates on problems of specific regions such as the Southern High Plains. However, we watch with interest other developments in technology that may affect tomorrow's water supplies.

The future will show whether it may become practical to remove salt from sea water economically, and to modify weather by cloud seeding, or other methods. Perhaps nuclear explosives may be used to create water reservoirs above and below ground and to get at previously untapped water underground.

The space age may have great impact on our own future research. For agriculture at least, the greatest returns from space research may come from weather satellites. They are certainly going to give us an understanding of weather that we have never had before. And the more you understand about something, the closer you are to developing practical means of dealing with it.

Until the Sixties, we learned about weather by looking <u>up</u> from widely spaced ground observation stations that missed vast areas of sea and snow and desert. Now, for the first time, man has an observation platform out in space, where cameras can look <u>down</u> on the earth and observe weathermaking wrong side out.

I understand that most Great Plains weather originates over the dry plateau of Mexico, the Gulf of Mexico, and the vast arctic tundra of northern Canada. Your most spectacular storms result when that moist Gulf air collides with dry polar air from Canada.

In May of 1960, the first Tiros weather satellite made cloud cover pictures -- topside pictures -- of severe storms over the Southern Great Plains where hailstones as large as baseballs were falling and tornadoes later developed.

The Tiros satellites feed back a staggering amount of such data. When enough information from these and future weather satellites is fed back and analyzed, somebody will come up with some generalizations. A pattern will emerge. Better knowledge of the movement of immense and faraway air masses may improve long-range weather forecasting. Turbulent weather, sighted in the making, may provide early warnings of local storms as well as of hurricanes.

I don't want to bring us down from above the clouds too fast. However, any research done here at Bushland must get closer to the ground.

We can be proud of the Station's past accomplishments, such as the equipment its scientists developed to make stubble-mulch farming an efficient defense against soil erosion, and the moisture-saving bench terraces that are now being adopted in many States. Perhaps the greatest accomplishment has been to pinpoint the characteristics and peculiarities of this area's soils.

Let's take a look at what soil and water research here must face for the future.

Whether it's the year 1963, 1980, or 2000, we will still be handicapped by the vagaries of weather. Moisture conservation will still be our most pressing need. It's almost pointless to plan for average weather in the Southern High Plains, where half the time the weather is abnormal.

Rainfall here at Bushland, for example, will probably still range from 12 to 33 inches a year, in erratic wet and dry cycles. It will seldom hit even close to the average of 19 or 20 inches a year. Some years, violent rainstorms may dump a third of the year's rain in a single day, or a fifth in a single hour.

Three-quarters of the rain will still fall in the growing season, when the hottest sun and winds can draw off the most moisture from the year's peak vegetation cover. Evaporation and transpiration by plants will still be capable of taking away several times as much moisture as rainfall provides. Crops, livestock and man must still withstand both the hot, dry winds of summer and the blizzards of winter.

We need a whole battery of soil and water practices in this area to make the best use of whatever rain falls. Probably nowhere do farmers and ranchmen need flexibility more than they do here, if drouth and flood are not to create crises every few years.

While we've had rather good luck in developing practices to ameliorate the ill effects of bad weather, we haven't yet learned how to take full advantage of good weather. When we have a good year, we can't be sure that we're getting maximum yield and storing up moisture for the future.

We must learn to use water where it falls as much as possible, and to salvage the runoff.

We must learn more about the climate near the ground -- microclimate -- which determines the needs of various crops for water. Techniques must be developed for reducing evaporation from the soil surface and for reducing the transpiration of excess water from the plants. Reduction of water losses by these means will vastly improve the efficiency of water use by agriculture. The field installations in microclimatology here are designed for just these purposes.

New knowledge in soil chemistry and fertilizer practices is needed to counteract the declining level of inherent soil fertility. The declining level of organic matter affects both the chemical and physical status of the soil.

It would be hard to find soils whose deteriorated structure is less adapted to soaking up erratic and often torrential rainfall than those of this area. Their low water intake -- as low as a twentieth of an inch an hour in Pullman soil -- makes the problem of soil compaction as acute here as anywhere else in the United States.

The team of soil scientists working on plowpans and related soil structural problems is making significant breakthroughs right here at the Bushland Station. Their basic studies are needed before our engineers can design the most effective equipment for opening up soil and counteracting the effects of plowpans.

Much of the grassland needed for tomorrow's livestock will come out of the Great Plains. The Southern High Plains can profitably send its native grass and its fodder, grain, and silage to market in beef cattle. This is natural country for grain sorghums, as the research-developed double dwarf milo and the newer hybrid sorghums have proved.

To make the most of such feeds and of grass, we need to learn more precisely how to graze and fatten livestock while conserving moisture and preventing soil erosion. We must learn how to establish and keep a good grass cover on depleted grassland and on cropland that should be returned to grass.

The most immediate problem in the Southern High Plains, of course, is that of disappearing ground water. In 1958, it was being mined 140 times as fast as it was being recharged by rainfall. At this rate, it could be gone in 15 years in some areas.

To check this drain, we must learn how to irrigate more efficiently. We've found that adding nitrogen to soil that grows grain can multiply the efficiency of use of irrigation water about $2\frac{1}{2}$ times. We are developing plans for typical Southern High Plains farms that will strike the most profitable balance in water and fertilizer use, irrigation design, and crop management.

We must increase the recharge of underground aquifers. Almost $1\frac{1}{2}$ million acre-feet of water accumulate each year in the more than 37,000 shallow playa lakes in these Plains, but nine-tenths of that water evaporates. Pumping this water back into the ground through multiple purpose wells offers much promise but presents many problems. We must learn how to get as much unused rainfall as we can into cold, widespread underground stores, where it can remain protected against evaporation and contamination for years or generations.

To solve such problems, many small solutions must be fitted together to create practical applications. And farmers and ranchmen must continue to put research results to use.

The Southern High Plains is one of the most important agricultural areas of the United States. And yet, it is beset with some of the most critical soil and water problems of the Nation. The Bushland Station, with new facilities and equipment, is moving forward rapidly to meet these challenges.

If the problems are tremendous, so are the possibilities. If agriculture here is a gamble, science must give odds to the farmers and ranchmen of today and tomorrow.

We face a future in which our soil and water resources are limited. We must count on technology, our most versatile resource, to augment the prosperity of this area and the future well-being of the Nation.

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